

*An Additional Note on the Production of High Permeability
in Iron.*

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The observations recorded in this paper may be regarded as an Appendix to a former paper,* elucidating a point which remained unsettled. It has been shown that if stalloy in laminated ring form is subjected to a magnetising force due to a direct current, and ranging from 3 to 14 C.G.S. units, whilst it is cooling through the temperature at which it regains its magnetic properties, and is at the same time shielded from the influence of the earth's magnetism, the permeability recovered at atmospheric temperature has a maximum value of over 10,000 when the magnetic induction is of the order 6000–7000 C.G.S. units.

It had been shown previously† that high values of the permeability can be obtained without the use of a special magnetic shield, when the iron has impressed upon it a magnetising force due to an alternating current, during the time that it cools through the temperature at which it regains magnetic properties. The authors of this last mentioned paper, however, used an iron tube to inclose the specimen, and the tube itself was heated with the specimen. It seemed, therefore, desirable to discover whether these high values of the permeability can be obtained when there is no question of magnetic shielding.

In a preliminary experiment a small stalloy ring, built up of stampings 0.042 cm. thick, was placed in a small cast-iron box and heated in a gas furnace to the neighbourhood of 800° C. It was subjected to a magnetising force of 13 C.G.S. units, due to a direct current, and allowed to cool to atmospheric temperature during application of the force. When cold, it gave a result in practical agreement with that obtained when stalloy is allowed to cool in a special shield; that is to say, the permeability had a maximum value of over 10,000 when the magnetic induction was of the order 6000–7000 C.G.S. units.

A fresh stalloy ring, built up of stampings 0.042 cm. thick, was then placed inside a small fire-clay crucible. It was allowed to cool as before from about

* 'Roy. Soc. Proc.,' A, vol. 90, p. 343 (1914).

† "The Annealing of Steel in an Alternating Magnetic Field," by H. Pender and R. L. Jones, 'Physical Review,' Second Series, vol. 1, No. 4, April, 1913.

800° C., when subjected to a magnetising force of 13 C.G.S. units, and a maximum permeability of over 10,000 was again obtained.

The conclusion is that it is not necessary specially to shield iron from the influence of the earth's magnetism in order to obtain high maximum permeability by the method of allowing it to cool through the temperature at which it regains magnetic properties, when it is subjected to a magnetising force ranging from 3 to 14 C.G.S. units due to a direct current.

Further experiments have been made with stalloy in the form of straight strips 8 cm. long, 1·5 cm. wide, and 0·053 cm. thick. Eight such strips were taken together to make up a test piece, which was wound with 43 turns of asbestos covered copper wire. The specimen was placed inside an iron tube, which was sealed at each end with an iron cap, the ends of the specimen touching the caps. The whole was then raised to a temperature of about 800° C., and allowed to cool inside a magnetic shield during the application of a direct current of 8·5 amperes in the magnetising coil. When cold, the specimen was removed from the iron tube and tested for permeability. The improvement was small, and had apparently disappeared when re-tested by the makers at their works.

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